



# Where Are We? Emergency Management, GIS, and Data Mining

Talbot Brooks

This work supported by:

The Critical Infrastructure and Key Resources Division, US  
Department of Homeland Security

And

USGS Cooperative Agreement 07ERAG0083



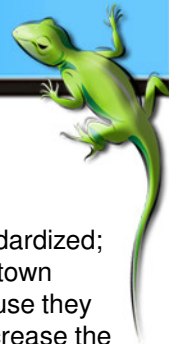


## Where I'm Coming From...





# Background



In those days, the thread on fire hydrants and fire hoses was not standardized; each county and city had its own kind of thread. When the first out-of-town firefighters rushed from Washington to help, they could do little. Because they could not use their fire hoses, the firefighters could only marginally increase the amount of water thrown on the fire. As a result, the fire took longer to put out than it would have otherwise.



Maryland Digital Cultural Heritage Project

<http://www.mdch.org/fire/#>



Fire departments learned the need for standardization the hard way when Baltimore burned in 1904



# A Painful Lesson Still Not Learned

## Interoperable Communications Post-9/11, Emergency Radios Still Not Connected

By: Alicia A. Caldwell, Associated Press  
09/01/11

SHARE    ...

WASHINGTON (AP) — Amid the chaos of the Sept. 11 attacks in 2001, emergency responders found they could not communicate with each other. That problem persists 10 years later, according to a review of the 9/11 Commission's recommendations.

A National Preparedness Group report released Wednesday concludes that the recommendation that a nationwide broadband network for emergency responders be created "continues to languish."

"Despite the lives at stake, the recommendation to improve radio interoperability for first responders has stalled because of a political fight over whether to allocate 10 MHz of radio spectrum ... directly to public safety for a nationwide network, or auction it off to a commercial wireless bidder who would then be required to provide priority access on its network dedicated to public safety during emergencies," says the report, whose authors include 9/11 Commission chairmen Lee Hamilton and Thomas Kean.





# 331 Years of Experience in the US



- Emergency services are standards based organizations
  - Standard of care
  - Interoperability/interchangeability
  - Organizational consistency (NIMS/ICS)
  - Scalability
  - Continuity of operations/common operating picture
- When the incident occurs IS NOT the time for innovation

George Washington was a volunteer firefighter with Friendship Veterans Fire Co.





# Take-away #1: When the crisis occurs is not the time to invent, improvise, or discover a lack of interoperability

- Understand basic needs and potential implementations before inserting solutions
- Solutions must be vetted, tested, and trained upon
- Train together!



Would you want my fire department's first use of a new set of Jaws-of-Life rescue tools to occur when you are trapped in your vehicle after a wreck? The analogy applies to any geospatial product you might insert during a crisis.







# Operational Friction?



Color	Symbol	Description	Notes
Black		Sector/planning boundaries	
Black		Travel barriers	Cliffs, etc.
Black		Modifications/updates to map	
Black		Branches Divisions	Consider naming divisions North, South, East, etc
Red		Point Last Seen or Last known position	Consider adding direction of travel
Red		Hazard	Write description
Blue		Incident Command Post	
Blue		Incident Base	Often same as CP
Blue		Staging area	Often same as CP
Blue		Helispot (location and #)	(LZ)

SUGGESTED FOR PLACEMENT ON BASE MAP		SUGGESTED FOR PLACEMENT ON OVERLAYS	
MINIMUM RECOMMENDED			
BLACK		HIGHLIGHTED GEOGRAPHIC OR MANMADE FEATURES	
BLACK		COMPLETED DOZER LINE	
BLACK		COMPLETED LINE	
RED		FIRE ORIGIN HAZARD (IDENTIFY TYPE OF HAZARD, E.G., POWER LINES)	
BLUE		INCIDENT COMMAND POST	
BLUE		INCIDENT BASE	
BLUE		CAMP (IDENTIFY BY NAME)	
BLUE		HELISPOT (LOCATION AND NUMBER)	
BLUE		HELIBASE	
OPTIONAL		REPEATER/MOBILE RELAY	
OPTIONAL		TELEPHONE	
OPTIONAL		FIRE STATION	
BLUE		WATER SOURCE (IDENTIFY, E.G., POND, CISTERN, HYDRANT)	
BLUE		MOBILE WEATHER UNIT	
BLUE		IR DOWN LINK	
BLUE		FIRST AID STATION	
RED		UNCONTROLLED FIRE EDGE	
RED		SPOT FIRE	
RED		HOT SPOT	
ORANGE		FIRE SPREAD PREDICTION	
BLACK		PLANNED FIRE LINE	
BLACK		PLANNED SECONDARY LINE	
BLACK		INITIALLY NUMBERED CLOCKWISE FROM FIRE ORIGIN	
BLACK		INITIALLY LETTERED CLOCKWISE FROM FIRE ORIGIN	
BLACK		COMBINE DIVISION LETTER WITH CLOCKWISE NUMBERING WITHIN THE DIVISION	
BLACK		WIND SPEED DIRECTION	
BLACK		PROPOSED DOZER LINE	
BLACK		FIRE BREAK (PLANNING OR INCOMPLETE)	
BLACK		STAGING AREA (IDENTIFY BY NAME)	



## Take-away #2: Crisis/emergency response is NOT about you



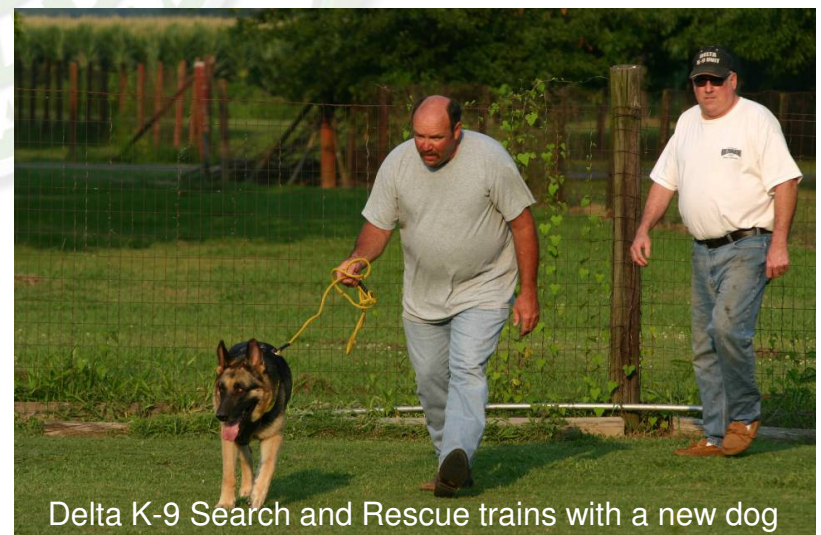
- It is about the preservation of life and property as facilitated by emergency responders who are **USERS** of geospatial products.
- It is about the population suffering loss and their need for geospatial products for recovery
- It is about facilitating the decision-making process for planning and mitigation.



# Without Further Horse Whipping...



- Geospatial technologies may play a crucial supporting role in crisis/emergency management
  - your map can save lives or contribute to their loss
- Standardization of spatial technologies as applicable to emergency response is required:
  - Planning
  - Mitigation/Prevention
  - Response
  - Recovery



Delta K-9 Search and Rescue trains with a new dog



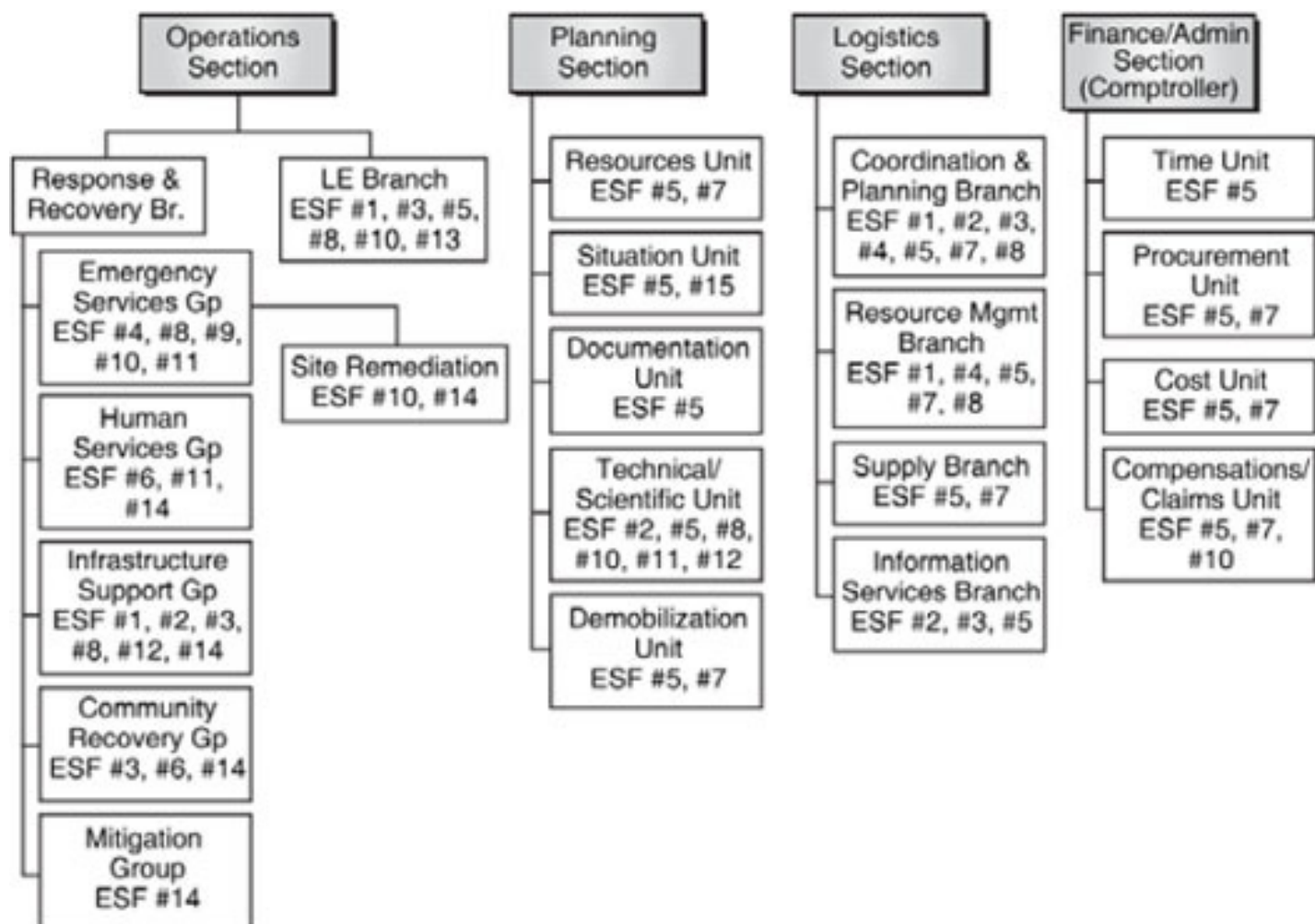


# Emergency Management and Response

- Structured and compartmentalized
  - Incident command system is nationally consistent and authorizes a single command authority backed by an organized chain of command
  - Broken into an operational structure with functional areas
  - It is flexible and scalable









# Take-away #3: Standards



- Standards exist within the emergency response community. Learn them:
  - FEMA Distance Learning Program for Incident Management
    - <http://training.fema.gov/IS/>
  - National Search and Rescue Committee
    - [http://www.uscg.mil/hq/cg5/cg534/nsarc/Georeferencing\\_info.asp](http://www.uscg.mil/hq/cg5/cg534/nsarc/Georeferencing_info.asp)
  - Wildland Fire
    - <http://gis.nwcg.gov/>
- Standards exist within the geospatial community. Learn them:
  - Federal Geographic Data Committee
    - <http://www.fgdc.gov/standards/projects>



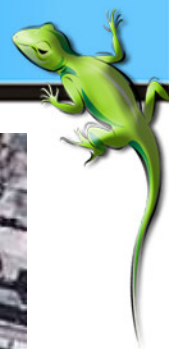


# A Fundamental Challenge and Chronic State of Denial For Emergency Responders



Many still remain homeless in Mississippi after Hurricane Katrina (2005)





The current official death toll in Haiti is 230,000 persons dead  
Imagery courtesy GeoEye via the Google cloud portal



## Fire Dispatching: "CAD Says..."

*Firehouse.Com Contributor*

**Updated:** 02-6-2009 1:06 pm

Computer Aided Dispatching is of course what we are referring to. You may have been following the recent story in Texas where the Dallas Police Department and Dallas Fire Department are dealing with many questions about the death of a police officer.

# Lost?



Firehouse Magazine (Billy Goldfedder)

Disasters and emergencies often remove the means by which we traditionally navigate our environment – street signs, house numbers, and other visual clues.

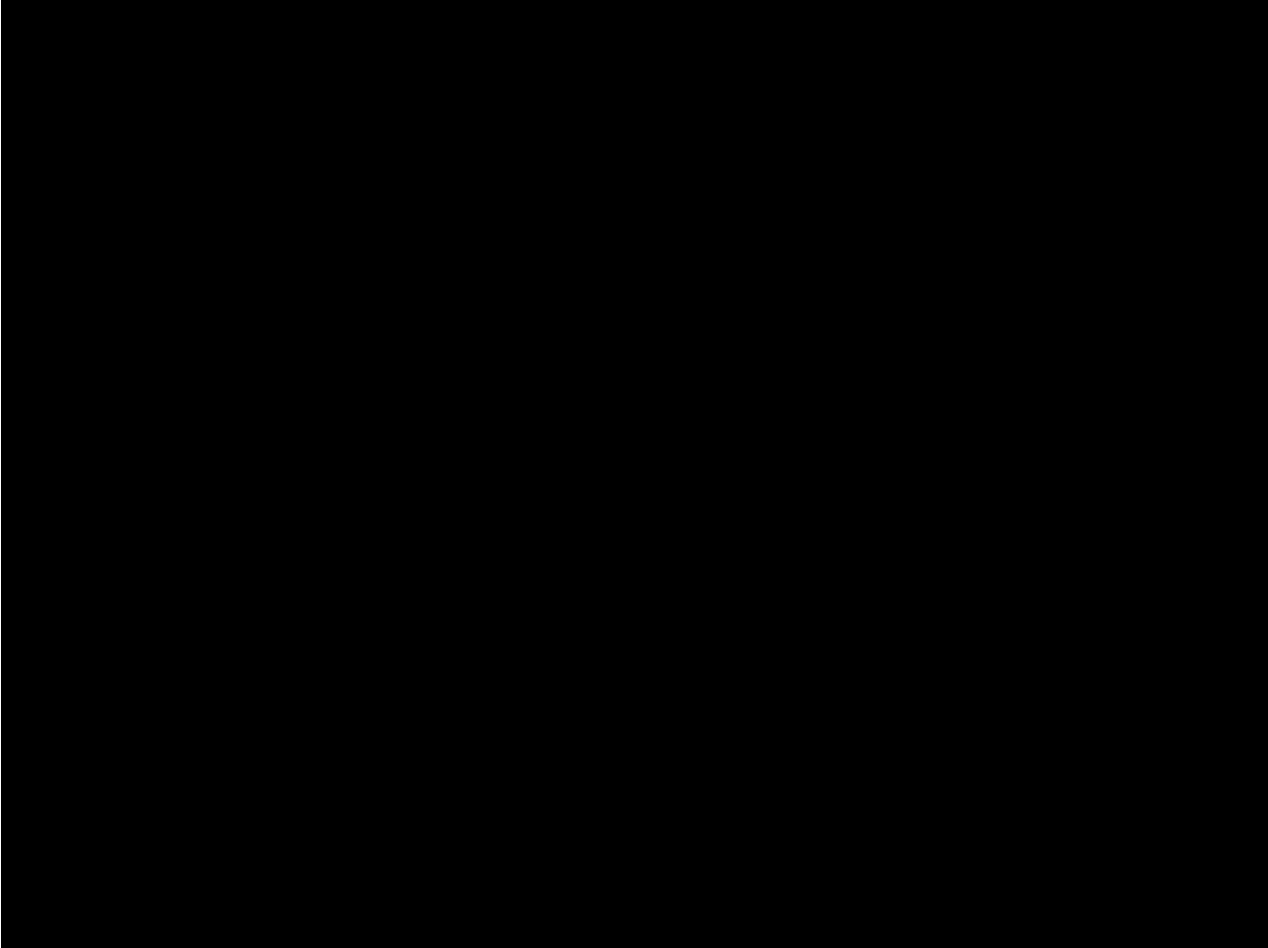
An analysis of the location field for all fire calls reported to the National Fire Information Reporting System for the 2000-2006 time period revealed that nearly a THIRD of all calls for service DO NOT occur at a street address.

Responders typically have intimate knowledge of their primary area of responsibility, but beyond that, we're lost.



Senior Cpl. Victor Lozada perished when his motorcycle crashed into a bridge abutment while escorting then Senator Clinton in Dallas after a campaign rally – 11 min. response time



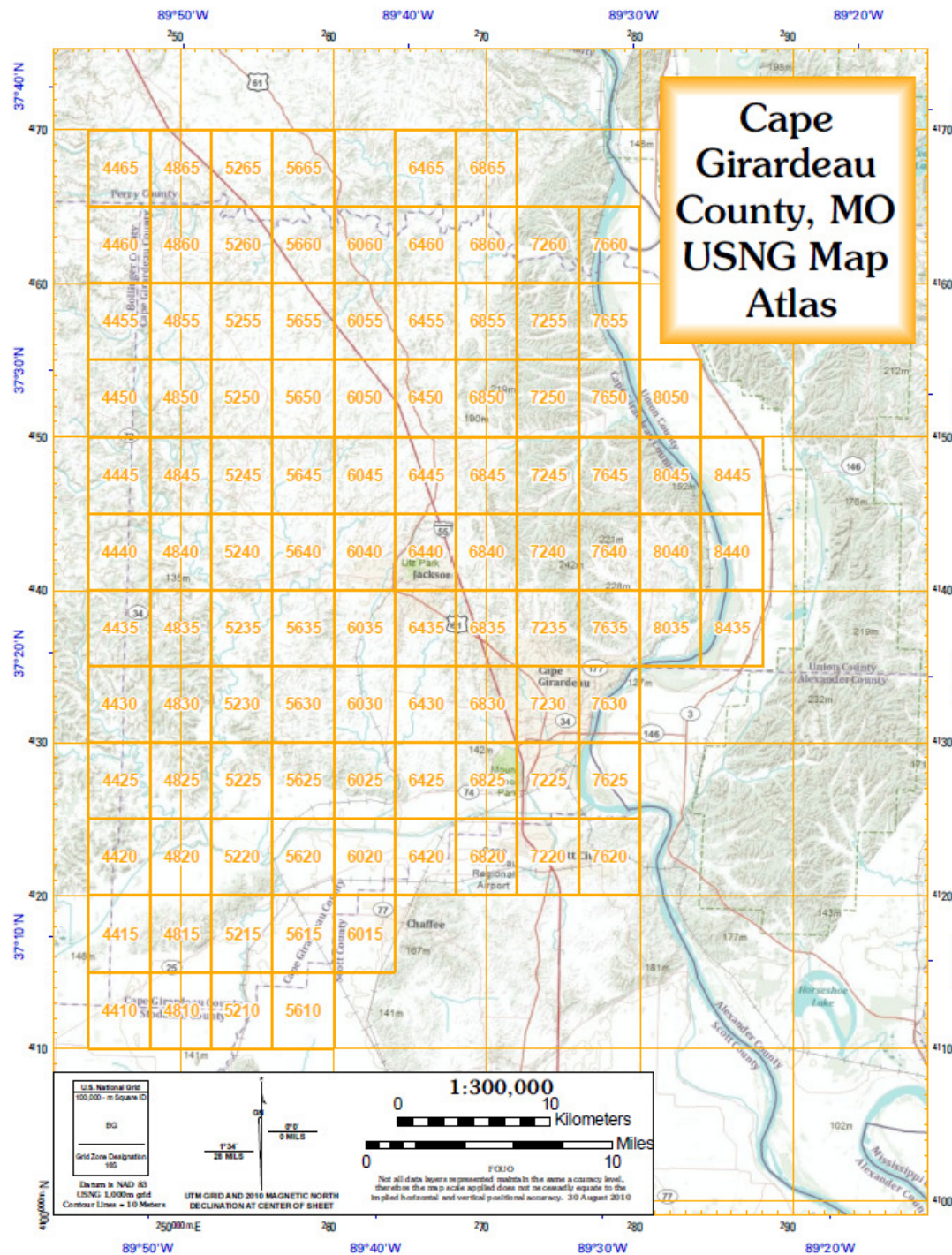




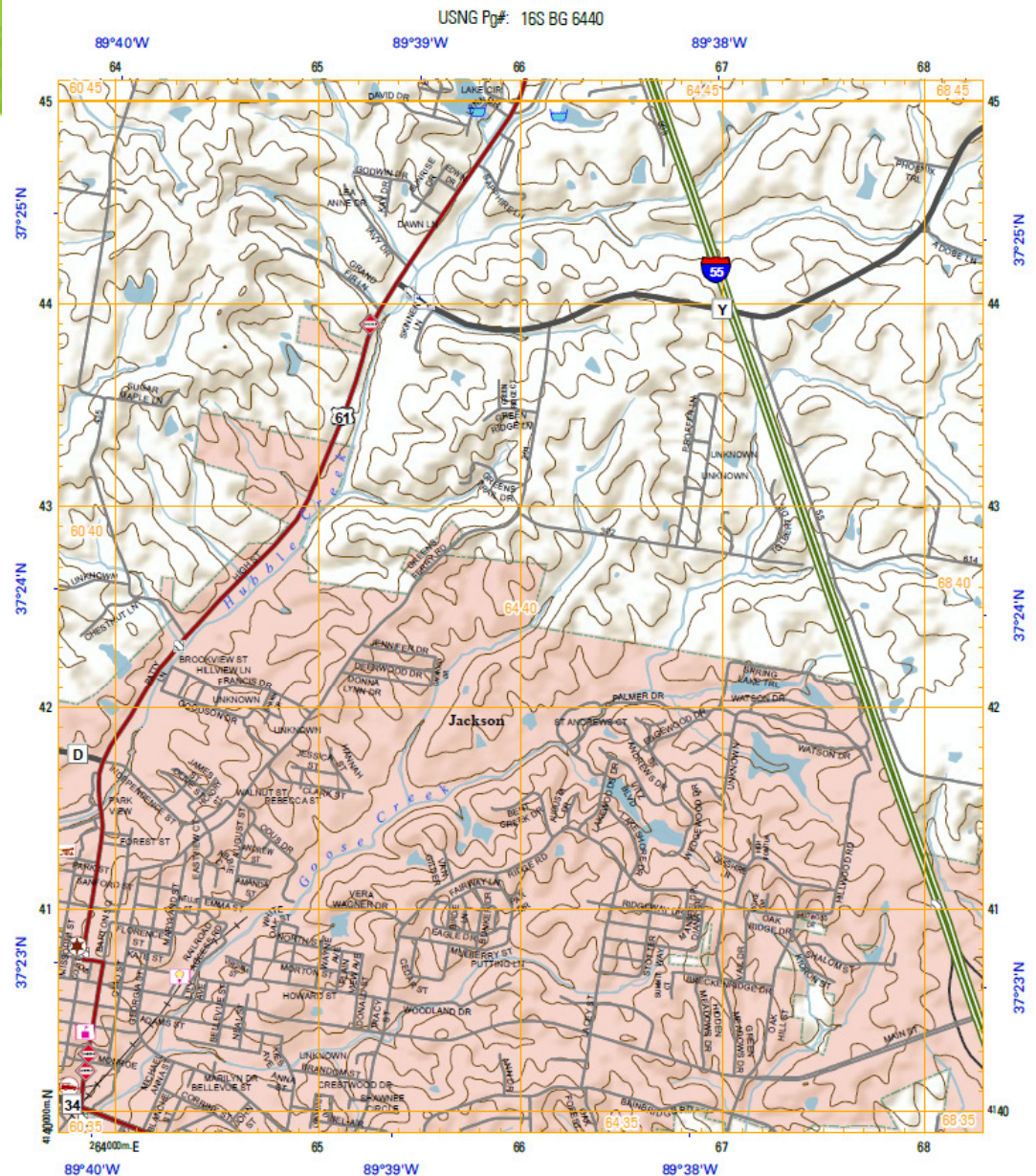
# Four Dead...





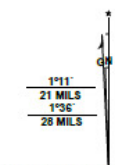






U.S. National Grid
100,000 - m Square ID
BG
Grid Zone Designation
16S

Datum is NAD 83  
USNG 1,000m grid  
Contour Lines = 10 Meters



UTM GRID AND 2010 MAGNETIC NORTH  
DECLINATION AT CENTER OF SHEET



FOUO  
Not all data layers represented maintain the same accuracy level,  
therefore the map scale applied does not necessarily equate to the  
implied horizontal and vertical positional accuracy. 30 August 2010

USNG Pg#: 16S BG 6440  
Cape Girardeau, MO

6045	6445	6845
6040	6440	6840
6035	6435	6835

Adjoining 4 km x 5 km Pages



# Take Away #4: Standards promote interoperability and facilitate efficiency



- **EXAMPLE: GEOADDRESSING**

- US National Grid is the only coordinate system for which an FGDC standard exists
- Continuing educational need with public (emergency responders are catching on quickly!)
- Continued work with vendor community to integrate USNG into their products (ex., Garmin Nuvi 500 and 550 Automotive GPS will navigate over roadways to USNG points, ESRI and Google Earth have incorporated USNG into their base viewer systems – must now go after Google Maps, Tom Tom, etc...)
- Work with other Federal agencies to make the standard attractive for use within their organizations



# This Is All About Some POS



- Land search and rescue is an exercise in high school math and geography
  - Probability of Detection
  - Probability of Containment
  - Probability of Success





# Take Away #5: What's "Old" is "New" Again

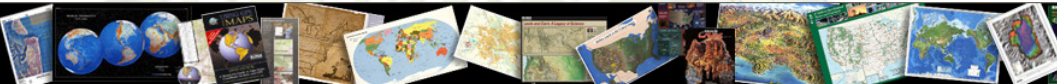





# <http://store.usgs.gov>

## (Choose "Map Locator")





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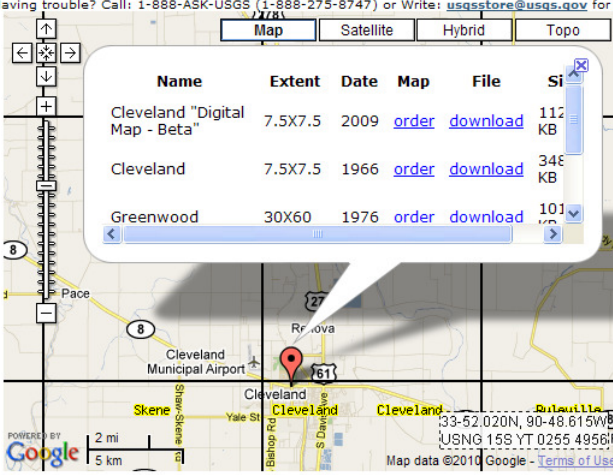
Don't see the Map Locator? [Help](#)

**Map Locator**

Having trouble? Call: 1-888-ASK-USGS (1-888-275-8747) or Write: [usgsstore@usgs.gov](mailto:usgsstore@usgs.gov) for help.

Map Satellite Hybrid Topo

Name	Extent	Date	Map	File	Size
Cleveland "Digital Map - Beta"	7.5X7.5	2009	<a href="#">order</a>	<a href="#">download</a>	112 KB
Cleveland	7.5X7.5	1966	<a href="#">order</a>	<a href="#">download</a>	348 KB
Greenwood	30X60	1976	<a href="#">order</a>	<a href="#">download</a>	101 KB



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[About GeoPDF Maps](#)  
[About US Topo](#)  
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**STEP 1.**

**SEARCH:** [\[Search Help\]](#)  
  
Search Type: [Address or Place](#)

**OR FIND A PLACE ON THE MAP**  
[\[Navigation Help\]](#)

FIRST, NAVIGATE around the map: double click to re-center, click and drag to pull the map around, zoom in and out.

THEN, MARK POINTS on the map: click on a place to add a marker .

NOTES:  
You can switch between Navigate and Mark Points at any time.

The following [map footprints](#) appear when you are in the Mark Points mode and zoomed in:

**STEP 2.**

**SELECT AND GET YOUR MAPS**

FIRST, click on the marker to see an information bubble showing maps available.

THEN, click on "order" and/or "download" to get the maps you want.

  
**Download Now**

Do more with GeoPDF:  
• **Annotate** with geospatial information  
• **Measure** distances and area, in your own coordinate system  
• **Integrate** with GPS tracking  
All with the Free TerraGo Toolbar!



# Big Picture: Crisis/emergency management



- Need for meeting needs for any given crisis/emergency plan, mitigation, response and recovery is based upon:
  - The multi-disciplinary nature of any event
  - The variety and degree of which of built infrastructures are interdependent
  - The willingness of stakeholders to embrace cooperative, standardized approaches that work towards and are appropriate for the audiences they **SERVE**



# The 2010 Haiti Earthquake

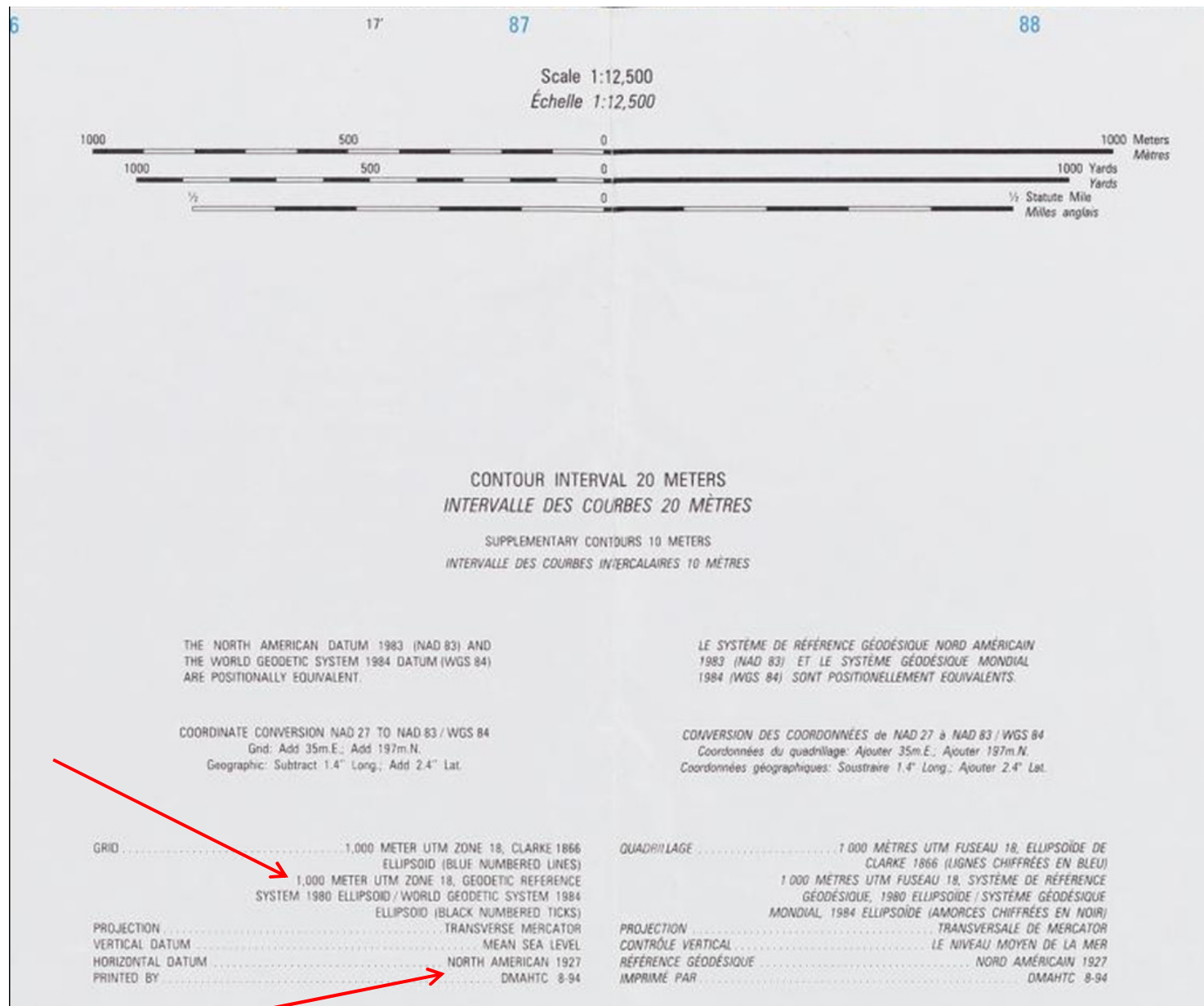


- At 15:53 CST on 12 January 2010 a 7.0 magnitude earthquake rocked the island nation of Haiti near the town of Léogâne while I was enroute from conducting a search and rescue mapping workshop with Maryland State Police
- Joe Toland, a senior GIS Analyst for FEMA, contacted me as I landed in Memphis and requested mapping support which included the provision of USNG/MGRS data and map products
- US-based assets were en-route and would arrive in less than 18 hours. Our challenge: Create large-scale standardized map products for an area the size of Connecticut in a third world country for which little geospatial data existed.

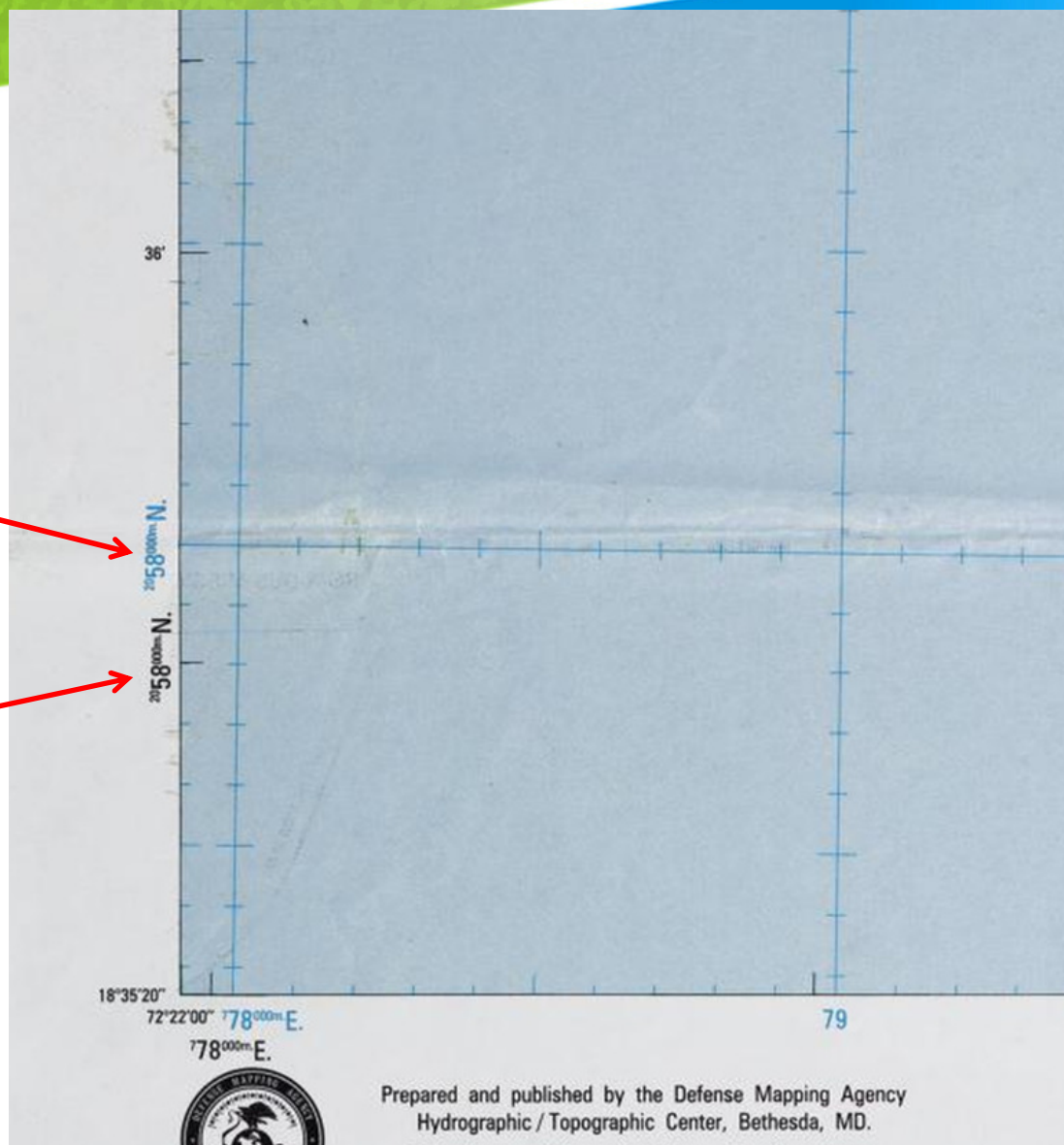
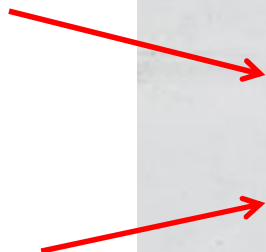








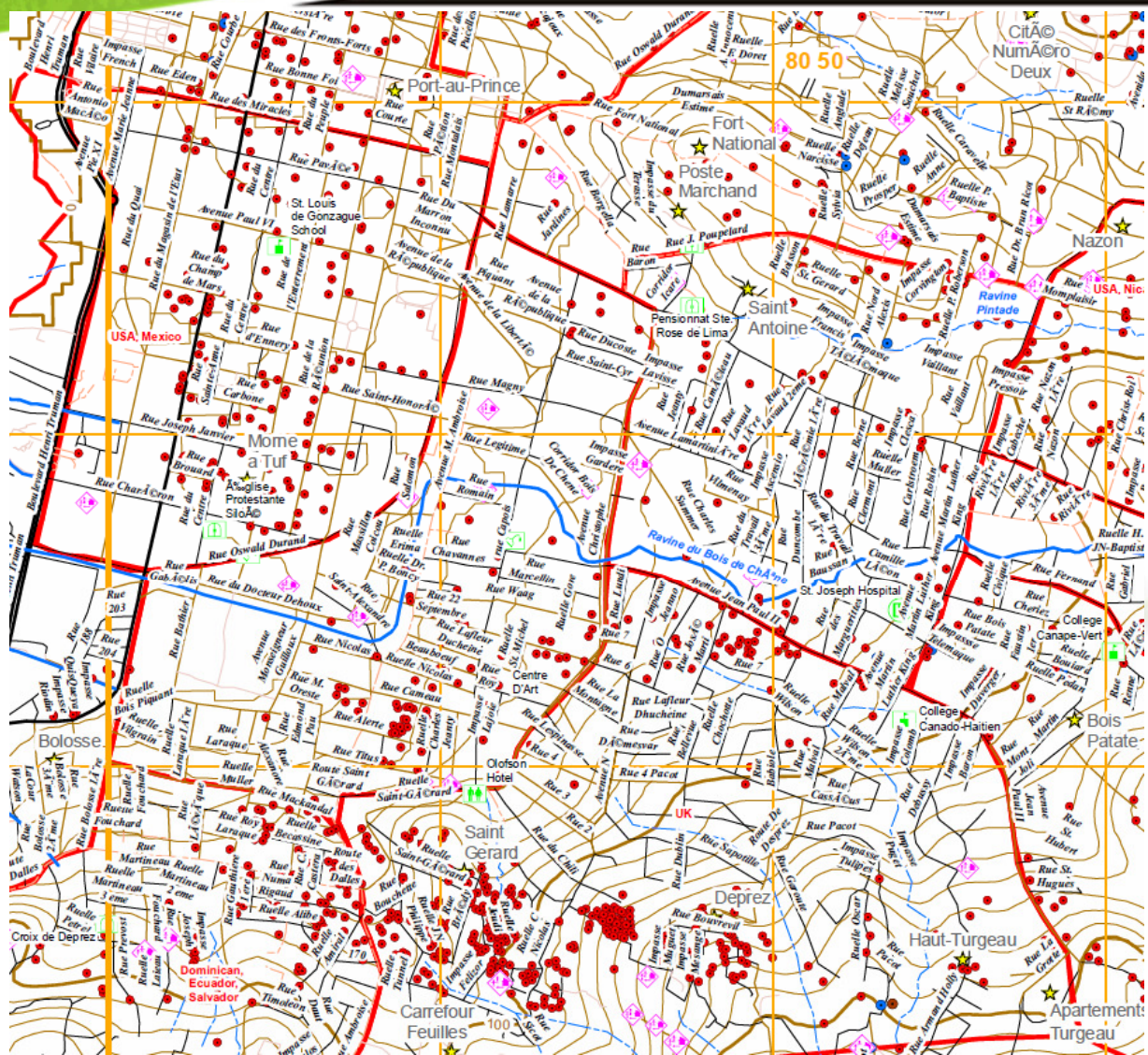














## OpenStreetMap



The Free Wiki World Map

### Search

Where am I?

port-au-prince

examples: 'Alkmaar', 'Regent Street, Cambridge', 'CB2 5AQ', or 'post offices near Lünen' [more examples...](#)

OpenStreetMap is a free editable map of the whole world. It is made by people like you.

OpenStreetMap allows you to view, edit and use geographical data in a collaborative way from anywhere on Earth.

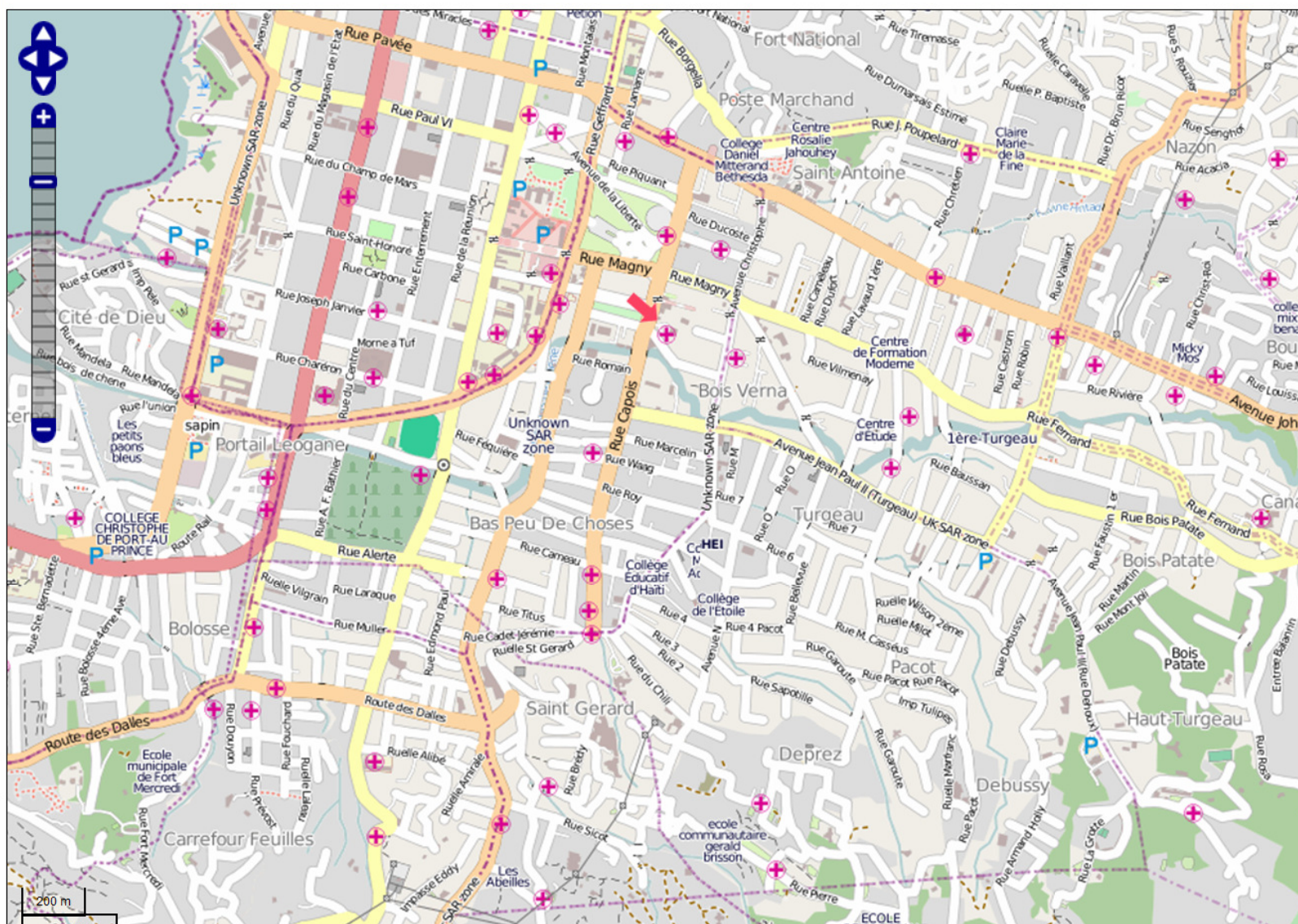
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# The Data Scramble



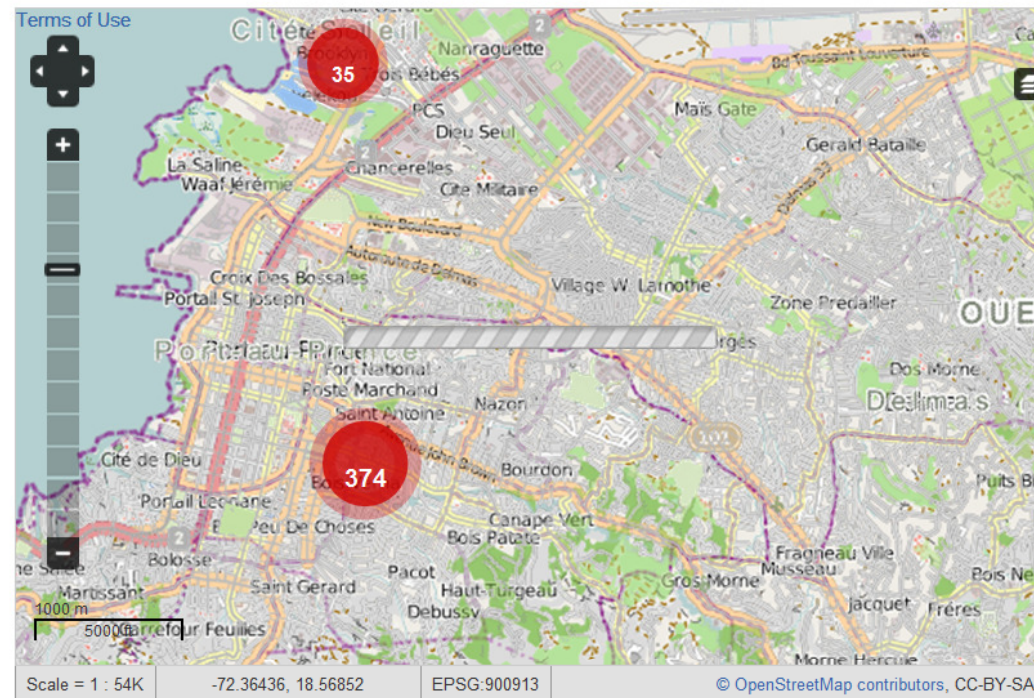
- The earthquake did not completely disrupt cell phone services, though local emergency numbers did fail. As a result, survivors trapped in debris called and/or sent text messages to relatives in cities such as New York, posted to Facebook or Twitter, which were in turn, forwarded to assistance agencies.
- CrisisMappers.Net stood up a listening service that permitted the geo-coding of such messages – it was called USHAHIDI



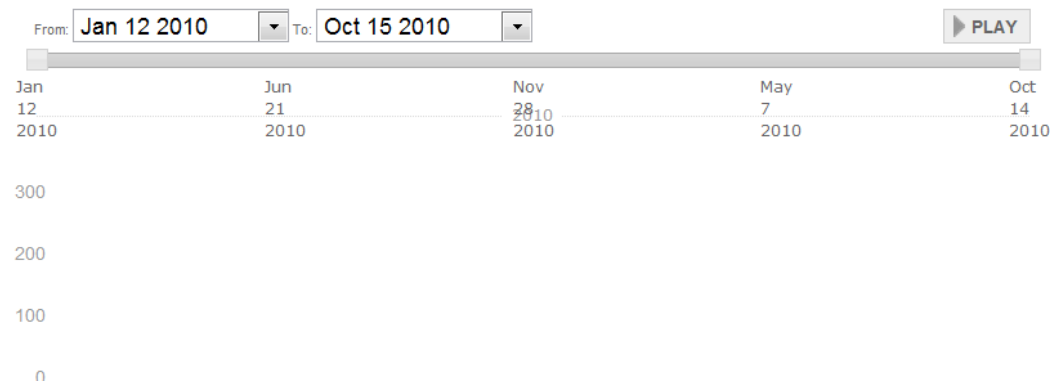


FILTERS → **REPORTS** NEWS PICTURES VIDEO TODO

VIEWS → **CLUSTERS**



#### ↓ TIMELINE OF EVENTS



#### ↓ CATEGORY FILTER

- ALL CATEGORIES**
- 1. URGENCES | EMERGENCY
  - 2. URGENCES LOGISTIQUES | VITAL LINES
  - 3. PUBLIC HEALTH
  - 4. MENACES | SECURITY THREATS
  - 5. INFRASTRUCTURE DAMAGE
  - 6. NATURAL HAZARDS
  - 7. SECOURS | SERVICES AVAILABLE
  - 8. AUTRE | OTHER

#### How to Report

- SMS/Text Local: 4636.  
SMS/Text International: +44 762.480.2524.
- Email: [haiti@ushahidi.com](mailto:haiti@ushahidi.com)
- Web Form: [Submit Report](#)







- While the USHAHADI team worked, GeoEye had satellites in the “right place” at the “right time” to capture post-event imagery. This imagery was processed near-real time and handed to Google.
- Google published the imagery for download and as a kml that could be loaded as a map service
- Open Street Map (<http://www.osm.org>) pushed the imagery to its constituents who vectorized features
- The result: the known street map of Haiti went from 9,000 named street segments to 72,000 in a period of about 3 days.



# Delta State GIS



- DSU GIS consumed data from these sources to produce printable map products that could accompany responders into the disaster zone.
- Maps are still available at <http://mississippi.deltastate.edu/data/haiti> - these products were created by a team of faculty and students starting with 1:25,000 scale maps (first 24 hours) and then 1:6,000 scale maps over the next 12 days.
- Map products were shared with Harvard (<http://news.harvard.edu/gazette/story/2010/03/portals-into-haiti-chile/>), FEMA, and USGS for distribution



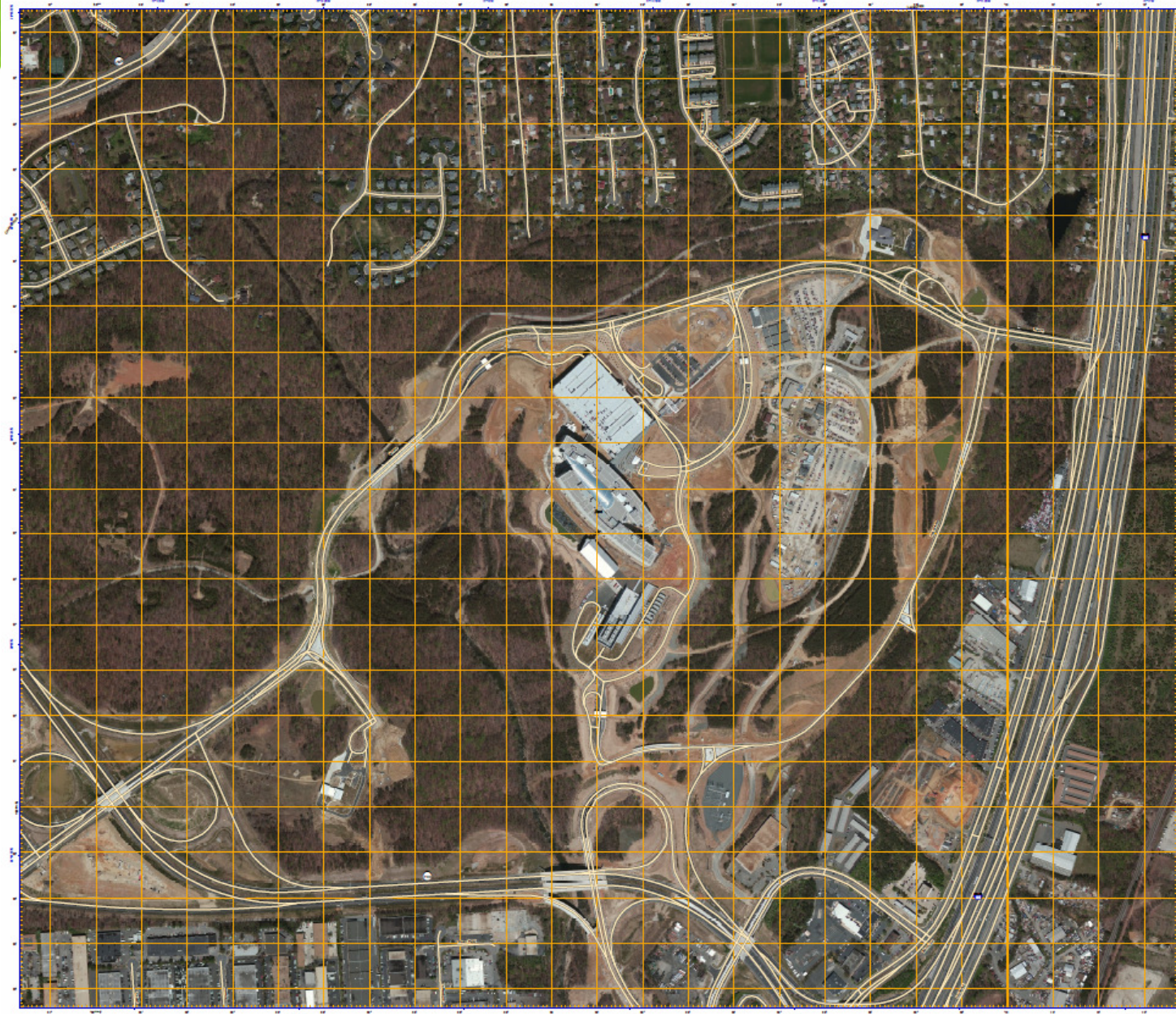


# The Final Takeaway: A New Paradigm

- Haiti taught us that “authoritative” data is not always so authoritative.
- Volunteered/crowd-sourced data may be of tremendous value (but can be difficult to use when not standardized).
- As spatial technologies advance, the level of technical ability required to interact with complex systems decreases thereby increasing access to ever broadening audiences.
- This has created a tremendous set of conundrums for the geospatial industry:
  - When is the use of crowd-sourced data appropriate?
  - Who owns the data and how may it be used?
  - What is the intrinsic and financial value of professionally-collected geospatial data and when is it required?
  - How does one protect “sensitive” or “restricted” data?
  - ...???



# NATIONAL GEOSPATIAL INTELLIGENCE AGENCY EAST CAMPUS



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The Free Wiki World Map

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Where am I?



examples: 'Alkmaar', 'Regent Street, Cambridge', 'CB2 5AQ', or 'post offices near Lünen' [more examples...](#)

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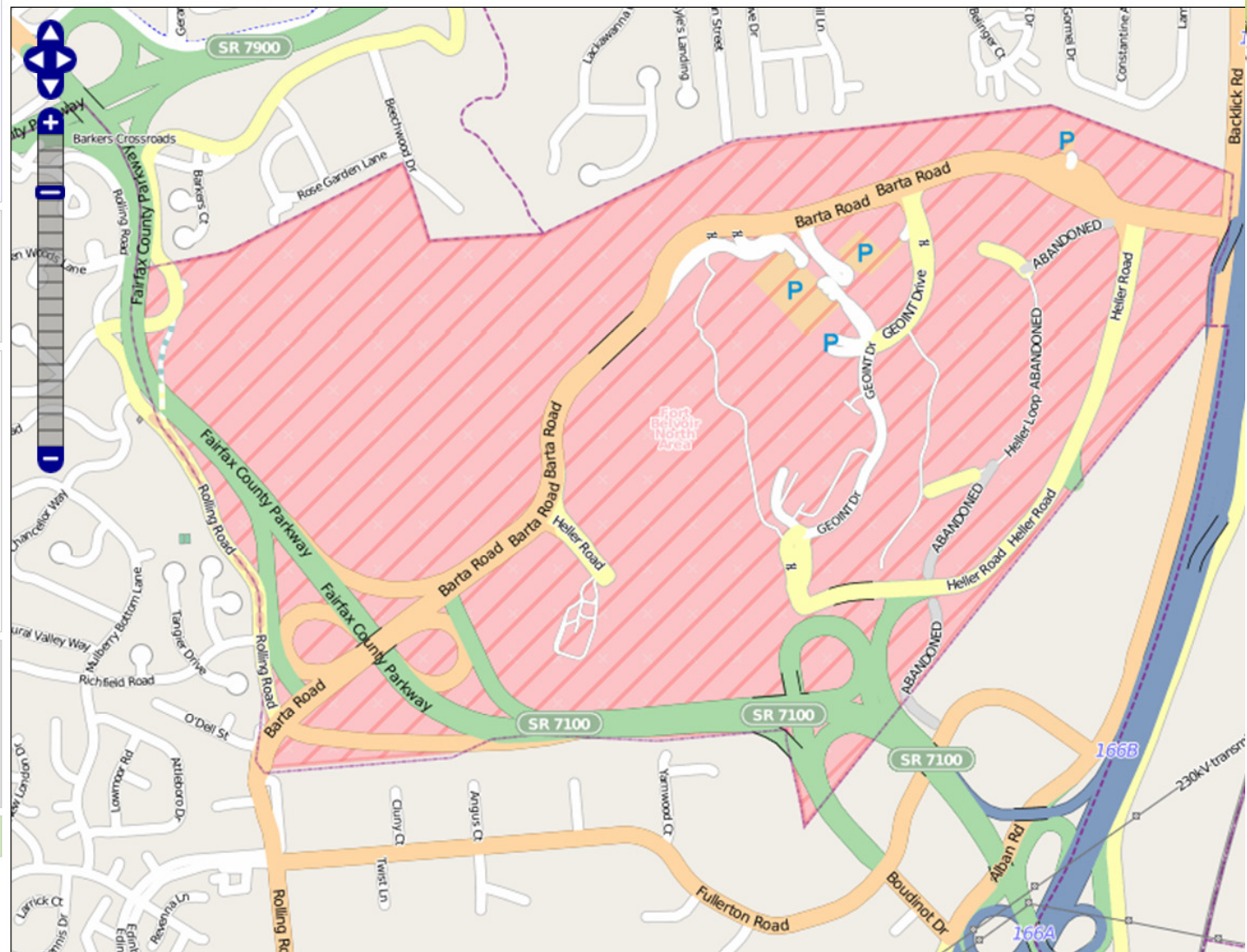
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View Edit History Export GPS Traces User Diaries





# New and Emerging Applications



- Open Street Map (<http://www.osm.org>)
  - Check out your neighborhood and try digitizing in some features
- Real-time traffic reporting (<http://apollo.smu.edu.sg/papers/mobisys11-traffic.pdf>)
- US Army – “Every soldier is a sensor” ([http://www3.ausa.org/PDFdocs/IP\\_Sensor08\\_04.pdf](http://www3.ausa.org/PDFdocs/IP_Sensor08_04.pdf))
- USGS – The National Map Corps (<http://nationalmap.gov/TheNationalMapCorps/index.html>)
- ESRI Community Maps Program (<http://www.esri.com/software/arcgis/community-maps-program/index.html>)



# Collaborate to live: Live to collaborate again



Talbot Brooks

[tbrooks@deltastate.edu](mailto:tbrooks@deltastate.edu)

662-588-8649

